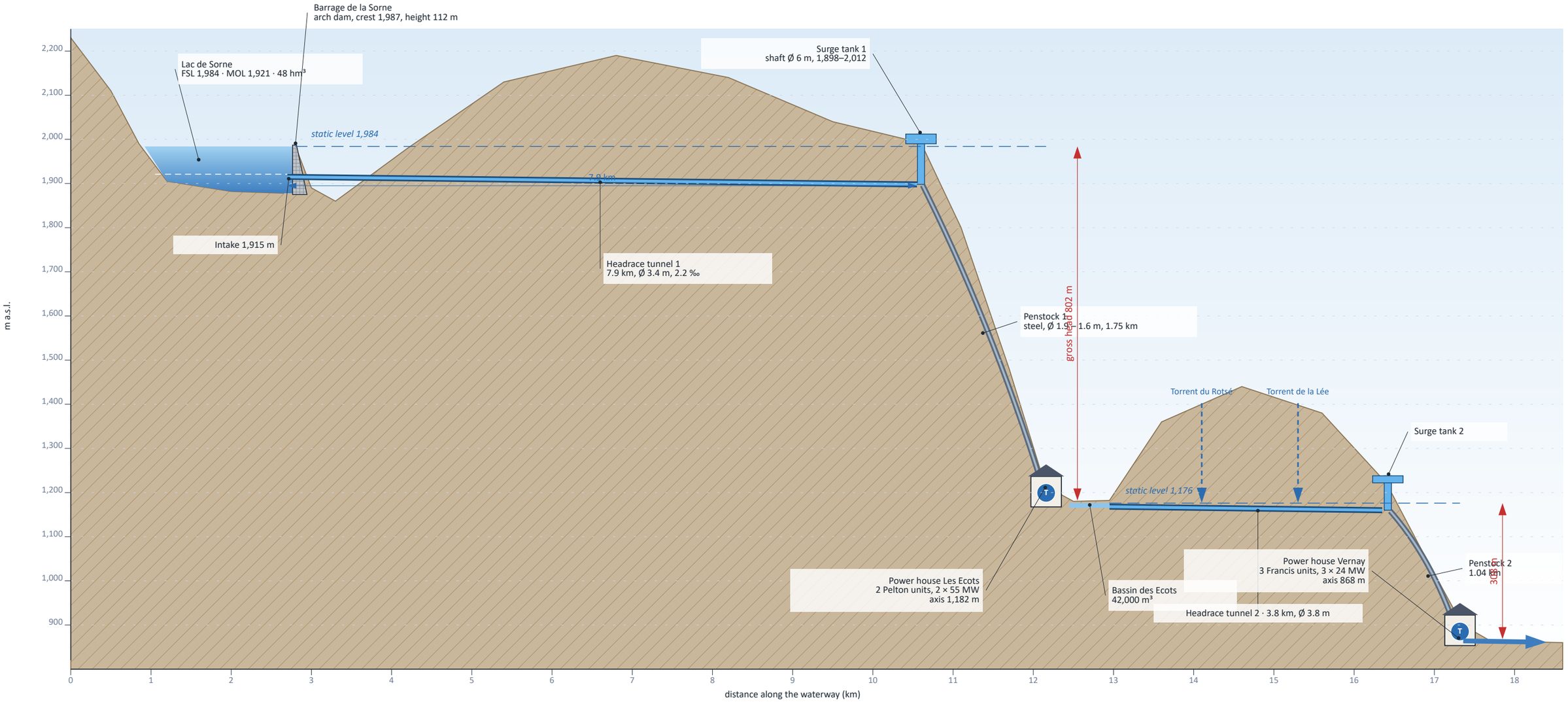
Val-Sorne scheme: longitudinal profile

Lac de Sorne – Les Ecots – Vernay · schematic, vertical scale exaggerated 5.5 ×

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Element	Main data	Element	Main data
Catchment	112 km² (38 % glaciated)	**Power house Les Ecots**	2 Pelton, 6 jets, 2 × 55 MW, 500 rpm
Lac de Sorne	48 hm³ usable, FSL 1,984 m	**Design discharge**	16.0 m³/s (Les Ecots), 27.0 m³/s (Vernay)
Barrage de la Sorne	concrete arch, H 112 m, crest 410 m	**Power house Vernay**	3 Francis, 3 × 24 MW, 600 rpm
Headrace 1 / 2	7.9 km Ø 3.4 m / 3.8 km Ø 3.8 m	**Annual production**	410 + 230 = 640 GWh
Penstock 1 / 2	1.75 km / 1.04 km, steel	**Commissioned**	1961, refurbished 2014–2019

Unit output

$$P = \eta \rho g Q H_n$$

Les Ecots: η 0.89, Q 8.0 m³/s per unit, Hn 788 m: P ≈ 55 MW per unit.

Elevations in metres above sea level (Swiss height system). Profile along the waterway axis, not to scale horizontally for the dam and the surge tanks. Sources: as-built drawings 2019, survey of the reservoir bed 2024.

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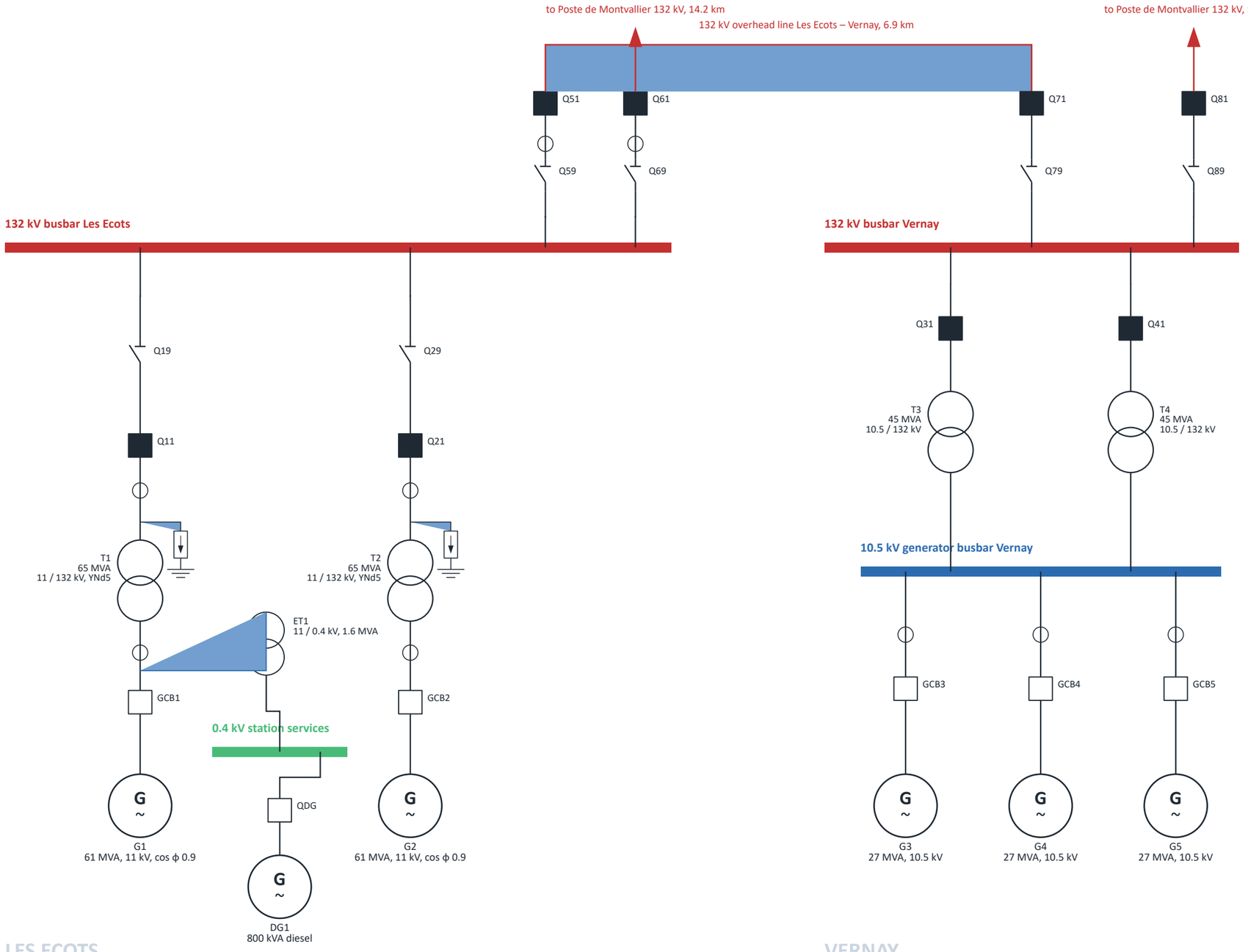
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Single-line diagram

Les Ecots and Vernay power houses, 132 kV substations and station services · normal operating state

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Symbols (IEC 60617 style)

- Synchronous generator
- Two-winding transformer
- Circuit breaker, closed
- Generator circuit breaker
- Disconnector
- Current transformer
- Surge arrester with earth
- Busbar: 132 kV / 11 kV / 0.4 kV

Unit	Type	Rating	Transformer
G1, G2	Pelton, vertical	61 MVA, 11 kV	T1, T2: 65 MVA
G3, G4, G5	Francis, vertical	27 MVA, 10.5 kV	T3, T4: 45 MVA
DG1	diesel, black start	800 kVA, 0.4 kV	–

Operating notes

Normal state shown: all breakers closed except QDG (diesel on standby).
Black start from DG1 via ET1 and GCB1; synchronising at GCB1 / GCB2.
Protection relays and bay controllers: see sheet 3 (network) and the protection settings list HVS-PRT-014.
Interlocking: Q*9 disconnectors can only operate with the associated breaker open.

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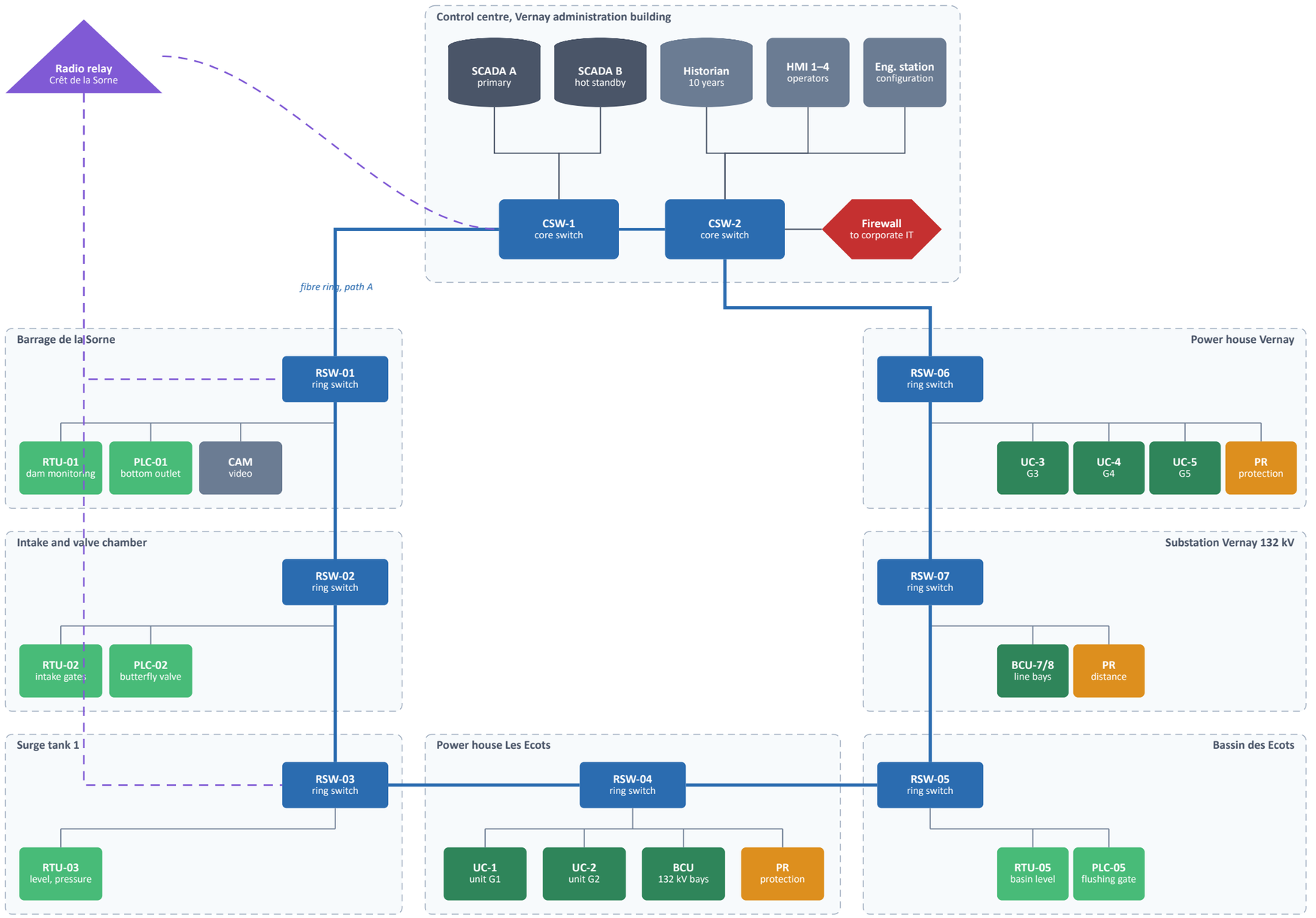
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SCADA and protection network

Dual fibre ring 1 Gbit/s, IEC 60870-5-104 to the control centre, IEC 61850 inside the power houses

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Links

- Fibre ring, single-mode, 1 Gbit/s, 2 × 24 fibres
- Copper, control centre LAN
- Station bus IEC 61850 / field devices
- Licensed radio backup, 2 Mbit/s

VLAN	Use	Subnet
10	SCADA servers, HMI	10.20.10.0/24
20	RTU / PLC, IEC 104	10.20.20.0/23
30	Unit controllers	10.20.30.0/24
40	Protection, IEC 61850	10.20.40.0/24
50	Video, access control	10.20.50.0/24
99	Network management	10.20.99.0/26

Design rules

Ring recovery below 50 ms (rapid ring protocol); each site keeps local control if both ring paths fail.

Only the firewall connects the OT network to corporate IT; remote access through the jump host, two-factor authentication.

Time synchronisation: GNSS master clocks at Vernay and Les Ecots, PTP on the station bus.

Radio backup carries IEC 104 alarms from the dam and surge tank 1 if the fibre is cut by avalanches.

Site	Controllers	Data points	Protocol to control centre	Autonomy (UPS / battery)
Barrage de la Sorne	RTU-01, PLC-01	412	IEC 104 over ring, radio backup	8 h, diesel 72 h
Intake, surge tank 1	RTU-02, PLC-02, RTU-03	186	IEC 104 over ring, radio backup (RTU-03)	8 h
Power house Les Ecots	UC-1, UC-2, BCU, PR	2 940	IEC 61850 station bus, IEC 104 gateway	4 h, DG1
Bassin des Ecots	RTU-05, PLC-05	128	IEC 104 over ring	8 h
Power house Vernay and substation	UC-3 to UC-5, BCU-7/8, PR	3 760	IEC 61850 station bus, IEC 104 gateway	4 h, grid + DG2

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